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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/549,683	09/19/2005	Jun Suda	HIRA.0204	1086
7590		01/24/2008		
Reed Smith Suite 1400 3110 Fairview Park Drive Falls Church, VA 22042			EXAMINER SONG, MATTHEW J	
			ART UNIT 1792	PAPER NUMBER
			MAIL DATE 01/24/2008	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>		<b>Applicant(s)</b>	
	10/549,683		SUDA ET AL.	
	<b>Examiner</b>		<b>Art Unit</b>	
	Matthew J. Song		1792	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 November 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 22-54 is/are pending in the application.
- 4a) Of the above claim(s) 27-39, 48, 49, and 53-54 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 22-26, 40-47 and 50-52 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/ are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election without traverse of Group I; claims 22-26, 40-47 and 50-52 in the reply filed on 11/5/2007 is acknowledged.
2. Claims 27-39, 48, 49, and 53-54 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 11/5/2007.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 22-23, 25-26, 40-42, 44, 47 and 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Powell et al (US 6,165,874) in view of Semond et al (WO 01/95380 A1), where US 2003/0136333 A1 is used as an accurate translations.

Powell et al teaches a method of growing a GaN film on a 6H-SiC substrate having steps 41 and terraces (Fig 5 and col 17, ln 50-67), where the terraces are the flat area between the steps. Powell et al also teaches forming GaN on the SiC substrate (col 18, ln 1-35 and col 22, ln 15-60).

Powell et al does not teach removing an oxide film, performing at least one cycle of Si or Ga irradiation, heating and then growing a Group III nitride.

In a method of growing GaN (a group III nitride), note entire reference, Semond et al teaches performing deoxidation by annealing to remove native oxide ('333 [0089]), this clearly suggests applicant's oxide removal step. Semond et al also teaches using a SiC substrate. ('333 [0039]) and using Molecular beam epitaxy to form GaN ('333 [0093]-[0098]), this clearly suggests irradiation with Ga because MBE comprises irradiation with Ga beams. Semond et al teaches growing GaN at 780°C, then heating to 900°C and then GaN growth at 780°C ('333 [0094]-[0097] and Fig 1).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Powell et al by using the method of GaN growth on a SiC substrate, taught by Semond et al, to produce a crack free GaN suitable for electronic devices ('333 [0002], [0040] and Abstract).

Referring to claims 23, 42 and 44, the combination of Powell et al and Semond et al teaches ultrahigh vacuum. ('333 [0106]).

Referring to claim 25, the combination of Powell et al and Semond et al teaches Ga MBE at 780°C heating to 900°C and then GaN deposition at 780°C ('333 [Fig 1]).

Referring to claims 26 and 47, the combination of Powell et al and Semond et al teaches a SiC substrate and an offset of 0°.

Referring to claims 40-41, the combination of Powell et al and Semond et al teaches forming a step-terrace structure, removing an oxide in an atmosphere of reduce oxygen (ultra high vacuum) and growing a GaN while the step terrace structure is maintained ('874 Fig 6 which shows the step terrace structure of the substrate is maintained after the layer 44 is formed.

Referring to claim 50, the combination of Powell et al and Semond et al teaches froming a step terrace structure, annealing to remove oxide, performing step flow growth to produce a flat surface ('874 col 14, ln 15-45 and col 17, ln 50-67); and performing a GaN layer growth followed by a second GaN layer growth, this clearly suggests feeding nitrogen after the group III element has been fed.

Referring to claim 51, the combination of Powell et al and Semond et al teaches feeding Ga, this clearly suggests a surface controlling element.

5. Claims 24, 43, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Powell et al (US 6,165,874) in view of Semond et al (WO 01/95380 A1), where US 2003/0136333 A1 is used as an accurate translations, as applied to claims 22-23, 25-26, 40-42, 44, 47 and 50-51, and further in view of Forbes et al (US 2004/0164341 A1).

The combination of Powell et al and Semond et al teach all of the limitations of claim 24, as discussed previously, except Ga irradiation performed under a high vacuum of  $10^{-6}$  Pa or less.

In a method of MBE of GaN, note entire reference, Forbes et al teaches GaN MBE epitaxy is performed under ultrahigh vacuum, which is typically  $10^{-10}$  Torr ( $1 \times 10^{-7}$  Pa).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Powell et al and Semond et al by using the pressure taught by Forbes et al., because the pressure is conventionally known to be used for MBE processes.

6. Claims 46 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Powell et al (US 6,165,874) in view of Semond et al (WO 01/95380 A1), where US 2003/0136333 A1 is used as an accurate translations, and in view of Forbes et al (US 2004/0164341 A1) as applied to claims 22-26, 40-45, 47 and 50-51 above, and further in view of Kitabatake (US 2001/0015170 A1).

The combination of Powell et al, Semond et al and Forbes et al teach all of the limitations of claim 46, as discussed previously, except the oxide film is removed using a solution containing fluorine.

In a method of preparing a SiC substrate having steps and terraces, note entire reference, Kitabatake teaches cleaning a SiC substrate by removing a silicon dioxide layer using a HF group acidic solution [0042]. Kitabatake also teaches the cleaning is effective on a silicon carbide surface having steps and terraces. [0053].

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Powell et al, Semond et al and Forbes et al by cleaning

the SiC substrate using an HF solution, as taught by Kitabatake to clean the oxide from the surface because oxide can be detrimental to subsequent film growth.

The combination of Powell et al, Semond et al, Forbes et al and Kitabatake does not explicitly teach the clean is performed in an oxygen reduced partial pressure, however it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Powell et al, Semond et al, Forbes et al and Kitabatake by cleaning in a oxygen reduce partial pressure because the clean is designed to remove oxide and performing in an oxygen reduce partial pressure would reduce the amount of oxide which would form before, during and after the oxide removal step.

### *Conclusion*

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on 571-272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Application/Control Number:  
10/549,683  
Art Unit: 1792

Page 7

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song  
Examiner  
Art Unit 1792

MJS  
January 22, 2008

*/Robert Kunemund/  
Robert Kunemund  
Primary Examiner  
TC 1700*